



SHIV NADAR UNIVERSITY

Graduate Prospectus

Ph.D in Life Sciences/Bioinformatics

**Department of Life Sciences
School of Natural Sciences
Shiv Nadar University
Post office Shiv Nadar University
Gautam Buddha Nagar
UP-201314**

2019 -20

About the Department

Research in the Department of Life Sciences is multifaceted with major focus in the areas of Malaria, Vascular biology, Bioinformatics, Genomics, Cancer biology, Virology, Bacterial genomics and morphogenesis, Plant Biology, Stress Biology, Neurobiology. The Life Sciences labs are well equipped with state-of-the-art research facilities and equipment like FACS ARIA III, Real Time PCR (ABI), Fluorescent Microscope, Mammalian cell culture (BSL-2) facility and central instrumentation facility having LCMS, XRD, AFM, Raman spectrometer, photoluminometer etc. Computational facilities at SNS include a high performance IBM cluster ("Magus") consisting of 32 compute nodes (plus two nodes with GPU processors) delivering 332.8 Giga flops with each node and a theoretical peak performance of 10.649 TF from over all compute nodes. Additionally, there are several standalone Linux machines that are being used for teaching and research purpose.

Life science faculty at SNU has been trained at top institutions in India and abroad, besides that life sciences department has state of the art lab facilities to professionally train the students in advanced technologies to solve complex biological problems. For more information on Department and faculty research areas please visit: http://snu.edu.in/naturalsciences/natural_sciences_life_sciences_faculty.aspx

Eligibility Criteria:

A candidate should have M.Sc. in any branch of Life Sciences/Bioinformatics, with a minimum of 60% marks or an equivalent grade point. Short-listed candidates will be required to demonstrate their knowledge through an on-site written test and interview. Candidates who have qualified for CSIR-UGC NET-JRF, DBT-JRF, ICMR-JRF or any other Government research fellowship are preferred, and will be exempted from the written test but they will have to undertake the interview.

Ph.D. Degree Program: Course Work

The Ph.D coursework is required to ensure that a graduate scholar has the required foundation for starting his/her research work. The coursework comprises core, elective and research methodology courses. Each scholar is expected to take a minimum of 12 credits per semester along with teaching/research assistantship throughout the graduate program. A scholar is expected to complete three core courses in first semester and one core course in spring semester however students is free to choose more courses from the list of elective courses along with that students are also encouraged to choose other departmental courses according

to his/her research interest. The Graduate Student Advisor/ committee will assist all the Ph.D. scholars in this process.

Graduate Student Advisor of the Department of Life Sciences: Dr Ashutosh Singh

Graduate Student Advisor Committee: Dr Ashutosh Singh, Dr Richa Priyadarshini, Dr Koyeli Mapa

The list of graduate courses offered by Department of Life Sciences are given below, however elective courses may change depending on the number of students opting for the courses and availability of faculty. Besides that, two courses **PTC 899: Practicum in Teaching** and **DTD 899: Doctoral Thesis** are also core courses for Ph.D students.

For more details on guidelines and regulation please refer to Ph.D guidelines/regulations of School of Natural Sciences, SNU.

Course Code	Course Name	L,T,P	Lab Duration
BIO700	Research Methodology	3,0,0	0
BIO701	Advanced Molecular Cell Biology	3,0,1	3
BIO704	Bioinformatics Essentials	2,0,1	3
BIO705	Advanced Instrumentation	2,0,1	3
Additionally, DTD 899 and PTC 899 will be available to students as core courses			

Course Name: Research Methodology

Course Code: BIO 700

Credit: 3

COURSE CONTENT:

Safety in laboratories general safety measures; personal protection; chemical hazards; spillage and waste disposal; first aid. Lab notebook writing, Patent and patent writing

Research methodology: Meaning of research; objective of research; motivation in research; types of research; research approaches; significance of research; Research and scientific methods; Importance of knowing how research is done; Research process; Criteria for good research.

Research problem design: Selecting research problem; necessity of defining a problem; techniques involved in defining the problem; basic principles of experimental design;

important experimental designs. statistical models and analyses that can be applied to different kinds of biological data, and statistical analyses.

Interpretation and report writing: significance of report writing; layout of research report; Presentation of research work- oral, poster and writing research paper; Precautions for writing research report.

Review of literature: Understanding the role of review; Writing research proposal, manuscript writing, research poster making and presentation, Characteristics of a proposal; content and organization of a proposal; weakness in proposal seeking funding. Writing of research proposal, report and Research paper. Ethical, legal, social and scientific issues in biological research. Plagiarism in science.

RECOMMENDED BOOK(S):

Methods in Biostatistics, BK Mahajan

Relevant papers and articles

Software: Uses of softwares, Urkund, ENDNOTE

COURSE TITLE:	Advanced Molecular and Cell Biology
COURSE CODE:	Bio701
CREDITS (L:T:P):	4 (3 L + 1P)

COURSE CONTENT:

Unit I

Basic structure of Cell and its biochemical compositions: protein, carbohydrate, lipid, nucleic acids. Cell membrane structure 'lipid bilayer', simple diffusion, active transport, osmosis, ion channel and pumps, mechanism of sorting and intracellular transport. Cell organelles and functions: Nucleus, Endoplasmic reticulum, Golgi complex, Mitochondria, Ribosomes, Lysosomes, Plastids and Chloroplast.

Unit II

Structure of DNA, DNA as genetic material, DNA replication, repair and recombination. Structure of RNA, types of RNA, transcription, methylation, capping & splicing, polyadenylation. Gene regulation- Inducers and repressors, transposons, RNA interference, long noncoding RNA.

Unit III

Genetic code and Triplet codons, overlapping genes and reading frames, differences in prokaryotes and eukaryotes gene organization. Protein synthesis, initiation factors and their

regulation, elongation and termination. Post-translational modifications, protein transport, protein turn-over.

Unit IV

Cell cycle and cell division- Mitosis and Meiosis, check point pathways, Cell signaling, hormones and their receptors, cell surface receptors, signal transduction pathways. Cell-Cell interaction, Cell senescence and death, apoptosis, Cell differentiation, Cancer.

Laboratory Practical's: DNA isolation and Quantitation of DNA by UV spectrophotometry, Polymerase Chain reaction (PCR), Protein estimation and visualization, Western blotting, Animal Cell culture and cell counting, Cell viability and cell cycle analysis, Lab safety, Bio imaging.

RECOMMENDED BOOK(S):

The Molecular Biology of The Cell by Bruce Alberts

Principles of Biochemistry, Lehninger

Classical review articles and scientific papers in area related to Molecular and cell biology

Course title: Advanced Instrumentation (Core)

Course code: BIO 703

Course credits: 3 (1L:0:2P)

COURSE CONTENT

This course will give the students rigorous hands on training and data analysis of different instruments used in Biology labs.

1. Gel Doc & data analysis
2. 2D gel electrophoresis
3. Mass Spectrometry (Maldi TOF)
4. Fluorescent and Confocal Microscopy
5. Ultra centrifugation
6. FACS its applications and data analysis
7. Real time PCR and Data analysis
8. FPLC & HPLC
9. LCMS
10. Diffractometer
11. AFM
12. NMR

RECOMMENDED BOOK(S):

Principles of techniques of Biochemistry and Molecular Biology, Wilson and Walker's.
Classical review articles and scientific papers in area related to Molecular techniques and instrumentation.

Principles of Biochemistry, Lehninger

Course Name : Bioinformatics Essentials (Core)

Course Code : BIO 704

Credits : 3 (2L: 1 P)

COURSE CONTENT:

Database searching methodologies: Nucleic acid sequence databases, Protein sequence database; Structure Databases, Pathway databases, Sequence file formats: Various file formats for bio-molecular sequences, Protein and nucleic acid properties: Various tools at the ExPASy server, searching methodologies.

Sequence Analysis: Basic concepts of sequence similarity, identity and homology concept, Scoring matrices, Matrices for nucleic acid and proteins sequences. **Sequence alignment:** Pairwise sequence alignment: Basic concepts of sequence alignment, Needleman and Wunsch, Smith and Waterman algorithms for pairwise alignments, gap penalties.

Unit II: Application of Bioinformatics

Drug designing methods, Drug Target Identification, Comparative Genomics and Proteomics, Identification of orthologous genes, Gene Identification methods, multiple sequence alignment methods, Phylogenetic methods, system Biology and Biological Networks, Structure prediction methods.

RECOMMENDED BOOK(S):

Mount, D.W., Bioinformatics: Sequence and Genome Analysis.

Bioinformatics and Functional Genomics by Jonathan Pevsner

Bioinformatics-A Practical Guide to the Analysis of Genes and Proteins

Current Protocols in Bioinformatics, Edited by A.D. Baxevanis et. al., Wiley Publishers

Classical Papers in Bioinformatics

ELECTIVES*

Course Code	Course Name
BIO 521	Structural biology
BIO 526	Cell signalling and Neurosciences
BIO 607	Host pathogen interactions & vascular dysfunction
Bio527	IPR, Patent laws and Bioethics
BIO524	Microbial Technology
BIO520	Next Generation Genomics: concepts methods and applications
BIO608	Cancer Biology

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Contact Information:

HOD Life Sciences

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